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DEPARTMENT OF COMMERCE

UNITED STATES BUREAU OF MINES
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UMBER, SIENNA, AND OTHER BROWN EARTH PIGMENTS

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DEPARTMENT OF COMMERCE - BUREAU OF MINES

UMBER, SIENNA, AND OTHER BROWN EARTH PIGMENTS[1]

By R. M. Santmyers[2]

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FOREWORD

Ocher and ochery earths, the most important of the naturally occurring earth pigments, have been covered in United States Bureau of Mines Information Circular 6132.

The present paper deals primarily with umber and sienna, together with other natural brown earth pigments, such as Vandyke brown or Cassel earth, Cappagh brown, Caledonian brown, Cologne earth, and mineral brown.

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[1] The Bureau of Mines will welcome reprinting of this article, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6504."

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GENERAL DESCRIPTION

Umber and sienna, like ocher, are naturally occurring mineral pigments composed largely of clay permeated with hydrated iron (ferric oxide), but they differ from ocher in that they also contain hydrated manganese oxide. The presence of manganese accounts for their browner color. In addition to silica and alumina (clay) and the coloring oxides of iron and manganese, these pigments often contain lime, barium, and other metallic salts as impurities.

Sienna most nearly approaches ocher in chemical composition, and the chief distinction is its physical character. It grades into ocher with decreasing iron content and into umber with increasing manganese content. Sienna is translucent rather than opaque and is more of a stain than a pigment; as the iron oxide content is rather high (often 60 to 80 per cent), the color is strong and rich and varies from pure brown to reddish brown. This pigment is known under several names: raw sienna, terra di Siena, and Italian earth.

Burnt sienna is a pigment of an orange-brown tint made by cautionsly calcining raw sienna. It is divided into two grades; American, and Italian burnt sienna.

American burnt sienna is a reddish-brown pigment containing from 25 to 60 per cent iron oxide (Fe_2O_3). One grade, found in Pennsylvania, analyses as high as 80 per cent and is known as double strength sienna.

Italian burnt sienna is a pigment generally containing more iron than the American product, averaging 60 to 75 per cent iron oxide.[3] American pigments of the same iron content differ materially in shade, having a Havana-brown color, whereas the Italian is more of a maroon. Italian siennas when tinted with 20 per cent of white, show a bluish tint, whereas American siennas yield a brownish or yellowish hue.

Raw umber, also known as Turkey umber, Levant umber, and terra ombra, is a greenish to yellowish brown siliceous and ferruginous earth, containing a considerable proportion of one or other of the higher oxides of manganese, Mn_3O_4 and MnO_2.[4] It is similar in many respects to raw sienna except that it is much coarser and contains more manganese oxide. All umbers contain over 5 per cent of manganese dioxide. Like sienna, umber is a permanent pigment, not being injured by light or by impure atmospheres.

Burnt umber (velvet brown, chestnut brown, etc.), results from the calcination of raw umber. The color is much richer and warmer than that of the raw umber. The colors are equally permanent and can be used in conjunction with all other durable pigments.

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[3] U. S. Tariff Commission, Tariff Information Survey, A-15, 1922, p. 79.
[4] Thorpe, E., A Dictionary of Applied Chemistry, London, vol. 5, 1924, p. 298.

Turkey umbers usually contain more manganese and iron than the American product. Umbers rich in manganese when calcined yield brighter shades in proportion to their fineness as determined either by grinding or levigation.

Other naturally occurring earth pigments are Cappagh brown, Caledonian brown, Vandyke brown, (Cassel earth), Cologne earth, and metallic or mineral brown.

Cappagh brown, also known as mineral brown, euchrome, etc., is a highly manganiferous and ferruginous earth obtained from the Cappagh mine, near Skibbereen, Ireland. When heated to 100° C. it loses water and assumes a fine reddish-brown hue like that of burnt sienna.

Caledonian brown possesses a reddish tint, altered upon ignition almost to black. This earth is composed chiefly of manganese and iron oxides and hydroxides.

Vandyke brown, also known as Cassel brown, Cassel earth, and Rubens brown, are terms applied more or less indiscriminately to pigments composed of clay, iron oxides, decomposed wood, peat, lignite, and other organic matter. These pigments are obtained from bog earth, peat, or lignite deposits and are essentially mixtures of clay or ocher with varying proportions of bituminous matter. Though of a fine rich hue, this variety of Vandyke brown is decidedly fugitive, especially in water color. Certain shades of umbers and siennas are called Vandyke browns.

Cologne earth is a bituminous (lignitic) Vandyke brown which has been gently roasted, in order to make the color darker and more permanent.

Metallic brown or mineral brown is made by calcining an impure iron oxide (limonitic iron ore). It usually contains from 40 to 75 per cent ferric oxide, averaging 50 per cent. It is variable in color but resembles burnt sienna.

PROPERTIES

All pigments consist of three parts: (1) The principal color-produc ingredient, which is usually hydrous iron oxide in brown earth pigments; (2) the secondary or modifying coloring ingredient, such as manganese for umbers and carbonaceous matter for brown and blacks; and (3) the base, filler, dilutent, or carrier of the color.[5]

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[5] Wilson, Hewitt, Ochers and Mineral Pigments of the Pacific Northwest; Bull. 304, Bureau of Mines, 1929, pp. 10-11.

The base in practically all naturally occurring earth pigments is clay. Clay is the weathered product of the silicate rocks, which contains sufficient hydrous silicate of alumina in the softened condition to produce a plastic or semiplastic mass when tempered with water. The composition of clay varies widely, hence the base compositions of most ochers, umbers, sienna, and other earth pigments may be quite different. This base composition, unlike that in artificial pigments, can only be changed or controlled by (1) selection or blending of varying portions of the deposit and (2) by removal of some impurities by simple purification methods.

USES

Umber, sienna, and other naturally occurring earth pigments containing the oxides of iron and manganese have, with the exception of color, much the same physical properties as ocher and are similarly used in industry.

There are two principal uses for umber and sienna - as a pigment in paints and for wood stains. As paint pigments, they are very permanent, have good covering power, mix well with all other durable pigments without alteration, are not affected by acids or alkalies, and are relatively inexpensive. As coloring agents, they are also used in linoleum, oil cloth, paper, etc., and to a minor extent in the ceramic industry.

Ground sienna is used in comparatively large amounts for lithographic and typographic printing and as an artist's color - either alone or as a base for lake pigments upon which organic coloring matters are precipitated from solution.[6] A popular lake of this type is mahogany (cashew) lake used for lithographic and letter-press printing. It is admirably suited for this purpose, as the lake dries very quickly. Sienna is translucent rather than opaque, and upon this characteristic is based its large use as a stain and colored wood filler for wood that is to be shellacked or varnished. In mixed paints, siennas are used for their tinting quality, the resulting shade being a yellowish maroon or salmon color. In the preparation of these paints, however, it is customary to mix two or more pigments together in order to produce a paint with the specified color and properties desired.

Umber has similar uses in paints but has a greater covering power than sienna. It yields very durable varnish paints that dry quickly and hard. Umber is an essential ingredient of weatherproof paints and gives an unusual variety of colors for house painting. A considerable quantity of umber is consumed in the wall paper industry to produce the ground shade.

American umbers and siennas are used in the most part as pigments and stains in the less expensive paints and color varnishes. However, umbers and siennas produced in Pennsylvania are used in all grades of paints, as the deposits are favorably situated in relation to consuming centers.

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[6] U. S. Tariff Commission, Work cited, pp. 79-80.

The other earth pigments containing iron and manganese, such as Cappagh brown, Caledonian brown, Vandyke brown, and metallic brown are used in the most part as substitutes for umbers and siennas, though those pigments may be classed as umbers and siennas containing varying amounts of iron and other oxides.

Vandyke or Cassel brown is not important as an oil color, as the paints dry slowly and has no great covering power, but it has a good body, is fairly permanent, and mixes well with other colors. The largest consumption is for wall and fancy paper making, for coloring cardboard and for the manufacture of wood stains.

SUBSTITUTES

Umber and sienna have no substitutes in the sense of similar cheaper products. While sienna is the most expensive of the common brown pigments the range in quality is such that the lower grades are cheaper than many of the pigments that could be classed as substitutes. Of these Vandyke or Cassel brown - essentially a mixture of clay or ocher with varying proportions of bituminous matter - is probably the most important.[7] Two other browns, more permanent in color than Vandyke brown but far less richly tinted, sold under the same name, consist of a brown variety of caput mortuum and a calcined ferruginous ocher, respectively. Imitation Vandyke browns are made, consisting of ocher, colcothar, and lampblack, in admixture. Other substitutes for Vandyke browns are made artificially from charred organic substances, such as bark, cork cuttings and bone dust. The various iron oxides, such as Spanish brown and colcothar, and artificial browns produced by chemical precipitation are also used. Brown lakes, except those containing umber, sienna, or ocher, are not used to any considerable extent as substitutes for these important pigments.

SOURCES OF SUPPLY

Little information has been published recently regarding the deposits of mineral pigments in the United States.

Neither umber nor sienna are produced in large amounts in this country, chiefly for the reason that the products of certain foreign countries have established an international reputation for quality.

In the United States, deposits of umber have been worked near Bethlehem, Doylestown, and Bethel in Pennsylvania, while sienna has been produced near Reading, Pa., and at Valley Station near West End, N. J. Umber could be produced also in the ocher and manganese district in the vicinity of Cartersville, Ga., if the demand existed.[8] Although many of the pigments produced in this country are called "ochers," their darker color and higher iron content should place them in the sienna class when they are compared with the lighter colored French ochers.

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[7] Ladoo, R. B., Non-Metallic Minerals, Occurrence, Preparation, Utilization: New York, 1925, p. 373.

[8] Wilson, Hewitt, Ochers and Mineral Pigments of the Pacific Northwest: Bull. 304, Bureau of Mines, 1929, p. 7.

Umber is produced in practically all countries, but the finest qualities are found in Cyprus, Sicily, Asia Minor, and the Netherlands. Turkish umber, chiefly from the island of Cyprus, is the standard. Italian sienna, produced in Tuscany, has the same preeminence in its field as Turkish umber or French ocher in the world markets. Germany is the only other important source of supply, sienna being produced along with considerable quantities of umber in the Harz Mountain district.

The other brown earth pigments are likewise produced in several countries.

It is reported that the original supplies of Cappagh brown, obtained from the Cappagh mine, near Skibbereen, Ireland, and Caledonian brown are exhausted. Substitutes for these pigments, consisting of a mixture of Vandyke brown and burnt sienna, however, are still sold under the same names.

The chief source of Vandyke or Cassel brown has been Germany, though it has been reported that a very acceptable type of this pigment occurs in abundance 6 miles east of Hanna, Wyo.

According to Ladoo:[9] "Similar material is also reported about 15 miles northwest of Putnam, N. Mex., and 8 miles south of Box Elder, Mont."

METHODS OF PREPARATION

The mining and preparation of umber and sienna do not differ essentially from the mining and preparation of ocher, which are described in Bureau of Mines Information Circular 6132. The following brief outline of the Italian method is taken from an unpublished consular report.

> During the warm seasons the raw sienna earth is excavated, after which it is usually washed in tanks, and the sienna, containing perhaps 70 to 80 per cent of water is banked in small piles and left in the sun to dry. Burning the sienna is extensively carried on at the place of excavation, but the major portion is shipped to Leghorn in the raw state and there treated.[10]

Processes of drying are extremely simple. Such of the raw material as is to be ground unburnt is first dried in kilns at a low heat, until about only 5 per cent of moisture remains. The material to be burnt is placed in a brickkiln under extreme heat. Charcoal is generally the fuel used. Buhrstone mills are used for final grinding.

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[9] Ladoo, R. B., Work cited, p. 373.

[10] Jackson, Jesse B., Sienna Earth - Production and Exportation: Consular Rept. 243515, Leghorn, Italy, March 31, 1927.

DOMESTIC PRODUCTION

The requirements of the paint producers in the United States for umber and sienna are met primarily by imports. Neither of these pigments is produced from domestic sources in any large amounts. Production statistics were gathered by the United States Geological Survey for several years but were discontinued in 1914. On account of the small production, figures for umber and sienna were combined. There is no known domestic production of natural Vandyke or Cassel brown.

Table 1 shows the production of umber and sienna separately in the United States for the years 1896 to 1902, while Table 2 shows the total production of these two pigments from 1903 to 1914, the last year for which official figures are available.

Table 3 shows the production of ocher, umber, sienna, and other iron-oxide pigments in the United States for the census years, 1919 to 1929.

Table 1.- Umber and sienna produced in the United States, 1896-1902[1]

Year	Umber, short tons	Value	Sienna, short tons	Value
1896	165	$ 2,646	395	$ 5,416
1897	2/ 1,080	11,710	620	10,610
1898	3/ 1,177	8,285	689	11,140
1899	473	4,151	688	8,205
1900	1,452	26,927	957	14,771
1901	759	11,326	305	9,304
1902	480	11,230	189	4,316

1/ Mineral Paints: Mineral Resources of the United States, Part II, Nonmetals, U. S. Geol. Survey (Annual).
2/ Includes 600 tons of Spanish brown from Maryland.
3/ Includes 640 tons of Spanish brown from Maryland.

Table 2.- Umber and sienna produced in the United States, 1903-1914[1]

Year	Umber and sienna		Year	Umber and sienna	
	Short tons	Value		Short tons	Value
1903	666	$15,367	1909	1,546	$43,872
1904	522	12,960	1910	1,015	26,700
1905	689	17,004	1911	1,005	26,225
1906	657	17,394	1912	805	21,975
1907	730	19,309	1913	776	20,790
1908	2/ 2,756	70,996	1914	790	21,070

1/ Mineral Paints: Mineral Resources of the United States, Part II, Nonmetals, U. S. Geol. Survey (Annual).
2/ Exceptional output (1,452 tons) of umber.

Table 3.- Ocher, umber, sienna, and other iron-oxide pigments produced in the United States [1]

Year	Pounds	Value
1919	202,181,787	$ 3,778,942
1921	82,757,631	1,737,478
1923	122,000,759	2,718,088
1925	57,063,165	1,285,294
1927	108,357,735	3,357,895
1929 2/	106,060,392	3,381,280

1/Census of Manufactures, Bureau of the Census (biannual).
2/Preliminary.

IMPORTS

Tables 4, 5, 6, 7, 8, and 9, show the imports for consumption of umber, sienna, Vandyke brown, and "all other mineral earth pigments."

The imports of umber and sienna, ground in oil or water, were not large prior to the World War. The imports of umber in oil or water, however, have increased considerably in recent years, and while figures for the same classification for sienna are not reported separately, they too, no doubt, have increased.

Both umber and sienna have been imported largely in crude form, but in recent years, the imports of powdered sienna have exceeded those of crude sienna.

In the case of Vandyke or Cassel brown, there has been a gradual increase in imports, although in 1930, due perhaps to general trade conditions, the imports of this pigment took a decided slump.

The imports of "all other mineral-earth pigments" have shown a downward trend, amounting to only 3,441 pounds in 1930 as compared with 1,325,168 pounds in 1923.

Table 4.-Imports for consumption of umber into the United States, 1901-1922[1]

	Dry		Ground in oil or water		Total	
Year	Pounds	Value	Pounds	Value	Pounds	Value
1901	1,562,247	- -	3,184	- -	1,565,431	$ 12,510
1902	1,887,426	- -	11,999	- -	1,899,425	16,133
1903	2,159,914	$ 17,685	9,656	$ 587	2,169,570	18,272
1904	2,261,793	19,727	13,133	784	2,274,926	20,511
1905	2,580,501	20,763	6,783	461	2,587,284	21,224
1906	2,948,539	23,732	6,028	418	2,954,567	24,150
1907	3,395,690	26,502	2,569	211	3,398,259	26,713
1908	2,391,153	19,461	15,556	803	2,406,709	20,264
1909	3,104,037	26,125	4,953	256	3,108,990	26,381
1910	3,994,286	28,819	11,813	734	4,006,099	29,553
1911	3,163,614	22,025	751	87	3,164,365	22,115
1912	4,857,706	31,408	3,179	218	4,860,885	31,626
1913	5,230,447	36,397	6,042	374	5,236,489	36,771
1914	2/	2/	2/	2/	7,886,716	45,280
1915	2/	2/	2/	2/	5,835,292	32,182
1916	2/	2/	2/	2/	10,405,923	69,470
1917	2/	2/	2/	2/	4,334,394	42,620
1918	2/	2/	2/	2/	487,623	13,895
1919	2/	2/	2/	2/	2,315,377	23,244
1920	2/	2/	2/	2/	7,643,235	85,424
1921	2/	2/	2/	2/	3,591,339	45,720
1922	2/	2/	2/	2/	4,927,957	55,554

1/ Foreign Commerce and Navigation of the United States (Annual); Bureau of Foreign and Domestic Commerce.

2/ Not separately classified.

Table 5.- Imports for consumption of umber into the United States, 1923-1930[1]

	Crude not ground		Washed or ground		Total	
Year	Pounds	Value	Pounds	Value	Pounds	Value
1923	7,386,658	$ 61,690	1,303,301	$ 29,433	8,689,959	$ 91,123
1924	6,895,473	58,303	1,258,694	27,134	8,154,167	85,437
1925	7,587,224	56,213	921,162	22,719	8,508,386	78,932
1926	5,775,040	36,688	1,324,283	48,106	7,099,323	84,794
1927	7,038,761	44,426	1,236,469	30,092	8,275,230	74,518
1928	6,264,844	39,182	1,290,679	29,667	7,555,523	68,849
1929	7,083,100	43,977	1,189,110	28,144	8,272,210	72,121
1930	3,678,044	23,128	1,052,048	22,339	4,730,092	45,467

1/ Foreign Commerce and Navigation of the United States (Annual), Bureau of Foreign and Domestic Commerce.

Table 6.- Imports for consumption of sienna into the United States[1]

Year	Dry or crude		Ground in oil or water		Total	
	Pounds	Value	Pounds	Value	Pounds	Value
1901	1,106,553	$ 18,394	2/ 13,861	2/$ 1,004	1,120,414	$ 19,398
1902	1,534,878	27,299	2/ 5,921	2/ 494	1,540,799	27,793
1903	1,873,532	28,447	1,387	123	1,874,919	28,570
1904	1,286,301	22,118	5,770	396	1,292,071	22,514
1905	1,737,909	26,097	2,886	227	1,740,795	26,324
1906	1,941,664	32,673	- -	- -	1,941,664	32,673
1907	2,176,566	34,752	14,629	864	2,191,195	35,616
1908	1,756,273	28,407	7,621	458	1,763,894	28,865
1909	2,402,901	32,913	6,114	421	2,409,015	33,334
1910	3,048,203	46,866	6,233	453	3,054,426	47,319
1911	2,888,365	36,995	9,927	667	2,898,292	37,662
1912	3,056,064	45,354	6,021	440	3,062,085	45,794
1913	3,270,715	48,443	2,502	92	3,273,217	48,535
1914	7,815,323	63,958	2/	2/	7,815,323	63,958
1915	6,105,515	65,283	2/	2/	6,105,515	65,283
1916	4,537,999	82,999	2/	2/	4,537,999	82,999
1917	2,643,748	57,330	2/	2/	2,643,748	57,330
1918	1,641,214	60,154	2/	2/	1,641,214	60,154
1919	1,734,807	46,134	2/	2/	1,734,807	46,134
1920	5,414,477	145,480	2/	2/	5,414,477	145,480
1921	2,545,398	104,284	2/	2/	2,545,398	104,284
1922	2,721,433	105,532	2/	2/	2,721,433	105,532
1923	2,660,018	83,177	2/	2/	2,660,018	83,177
1924	1,501,490	42,473	2/	2/	1,501,490	42,473
1925	1,385,608	34,809	2/	2/	1,385,608	34,809
1926	2,018,289	49,432	2/	2/	2,018,289	49,432
1927	1,668,065	42,831	2/	2/	1,668,065	42,831
1928	1,591,935	50,013	2/	2/	1,591,935	50,013
1929	1,676,663	47,378	2/	2/	1,676,663	47,378
1930	901,879	34,747	2/	2/	901,879	34,747

1/ Foreign Commerce and Navigation of the United States (Annual), Bureau of Foreign and Domestic Commerce.

2/ Not separately classified.

Table 7.- Imports for consumption of sienna and ocher into the United States, 1922-1930 [1]

Year	Sienna and ocher washed or ground	
	Pounds	Value
1922	[2] 4,802,012	70,960
1923	17,470,629	238,338
1924	17,994,225	204,237
1925	18,651,893	238,258
1926	18,521,765	334,693
1927	18,920,745	395,684
1928	18,492,511	366,806
1929	18,979,131	343,111
1930	12,292,216	203,031

[1] Foreign Commerce and Navigation of the United States (Annual), Bureau of Foreign and Domestic Commerce.

[2] Sept. 22 to Dec. 31.

Table 8.- Vandyke brown, Cassel earth or Cassel brown imported for consumption into the United States [1]

Year	Pounds	Value
1911	- -	$ 491
1912	- -	3,192
1913	- -	2,187
1914	- -	1,302
1915	- -	1,208
1916	- -	790
1917	- -	2,759
1918	33,600	2,573
1919	70,002	2,416
1920	601,646	22,821
1921	213,278	5,334
1922	420,756	10,097
1923	412,014	10,252
1924	477,339	9,651
1925	734,618	12,783
1926	1,475,975	22,862
1927	1,108,031	19,334
1928	1,260,067	22,530
1929	1,363,097	24,581
1930	952,927	19,096

[1] Foreign Commerce and Navigation of the United States (Annual), Bureau of Foreign and Domestic Commerce.

Table 9.- "All other mineral-earth pigments" imported for consumption into the United States [1]

Year	Pounds	Value
1922 2/	34,350	$ 5,467
1923	1,325,168	53,340
1924	240,481	9,517
1925	235,442	8,716
1926	29,396	2,708
1927	257,885	2,553
1928	15,734	1,307
1929	6,610	1,786
1930	3,441	2,106

1/ Foreign Commerce and Navigation of the United States (Annual), Bureau of Foreign and Domestic Commerce.

2/ Sept. 22 to Dec. 31.

TARIFF HISTORY

Umber and sienna, together with ocher, were first mentioned specifically in the tariff act of 1883. Subsequently, except under the tariff act of 1894, they have been dutiable as shown in Table 10.

Table 10.- Tariff rates on ocher, umber and sienna

Act of-	Par.	Tariff classification or description	Rates of duty, specific and ad valorem
1883	---	Ocher and ochery earths, umber and umber earths, and sienna and sienna earths, when dry	½ cent per pound
		When ground in oil	1½ cents per pound
1890	54	Ocher and ochery earth, sienna and sienna earths, umber and umber earths, not specilly provided for in this act, dry	¼ cent per pound
		Ground in oil	1½ cents per pound
1894	42	Ocher and ochery earths, sienna and sienna earths, umber and umber earths, ground in oil	1¼ cents per pound
1894	566	Ocher and ochery earths, sienna and sienna earths, umber and umber earths, not specially provided for in this act, dry	Free.
1897	49	Ocher and ochery earths, sienna and sienna earths, umber and umber earths, not specially provided for, when crude or not powdered, washed, or pulverized	1/8 cent per pound
		If powdered, washed, or pulverized	3/8 cent per pound
		If ground in oil or water	1½ cents per pound

Table 10.- Tariff rates on ocher, umber and sienna - Cont'd

Act of-	Par.	Tariff classification or description	Rates of duty, specific and ad valorem
1909	47	Ocher and ochery earths, sienna and sienna earths, and umber and umber earths, not specially provided for in this section, when crude or not powdered, washed, or pulverized	1/8 cent per pound
		If powdered, washed, or pulverized	3/8 cent per pound
		If ground in oil or water	1 cent per pound
1913	55	Ocher and ochery earths, sienna and sienna earths, and umber and umber earths	5 per cent ad valorem.
1922	75	Ochers, siennas, and umbers, crude or not ground	1/8 cent per pound
		Washed or ground	3/8 cent per pound
1930	73	Ochers, siennas, and umbers, crude or not ground	1/8 cent per pound
		Washed or ground	3/8 cent per pound

Vandyke brown and other brown earth pigments, with the exception of ocher, umber, and sienna, have always come under the blanket clauses of the several tariff acts as a color or pigments not otherwise specially provided for. Since 1883 they have been dutiable at from 15 to 30 per cent ad valorem, the low duty under the act of 1913 and the high duty under the acts of 1890 and 1897. The present duty of 25 per cent ad valorem (par. 66, act of 1930) is the same as that under the act of 1922.

Table 11 shows the rates of duty under this classification which includes Vandyke brown and other earth pigments, with the exception as noted above.

Table 11.- Tariff rates on paints, etc., not elsewhere specified

Act of-	Par.	Tariff classification or description	Rates of duty, specific and ad valorem
1883	87	Colors and paints, whether dry or mixed, or ground with water or oil, and not specially enumerated or provided for in this act	25 per cent ad valorem
1890	61	All other paints and colors, whether dry or mixed, or ground in water or oil, not specially provided for in this act, and artists' colors of all kinds, in tubes or otherwise	Do
		All paints and colors, mixed or ground with water or solutions other than oil, and commercially known as artists' water-color paints	30 per cent ad valorem

Table 11.- Tariff rates on paints, etc., not elsewhere specified - Cont'd

Act of-	Par.	Tariff classification or description	Rates of duty, specific and ad valorem
1894	48	All other paints, colors, and pigments, whether dry or mixed, or ground in water or oil, or other solutions, including all colors in tubes, and not specially provided for in this act	25 per cent ad valorem
1897	58	All paints, colors, pigments whether crude or dry or mixed, or ground with water or oil or with solutions other than oil, not otherwise specially provided for in this act	30 per cent ad valorem
		All paints, colors, and pigments, commonly known as artists' paints or colors, whether in tubes, pans, cakes, or other forms	Do.
1909	56	All paints, colors, pigments, stains, whether crude or dry or mixed, or ground with water or oil or with solutions other than oil, not otherwise specially provided for in this section....	Do.
		All paints, colors, and pigments commonly known as artists' paints or colors, whether in tubes, pans, cakes, or other forms	Do.
1909	51	Enamel paints made with varnish	Do.
1913	63	Enamel paints, and all paints, colors, pigments, stains, whether crude, dry, mixed, or ground with water or oil or with solutions other than oil, not specially provided for in this section	15 per cent ad valorem
		All paints, colors, and pigments commonly known as artists' paints or colors, whether in tubes, pans, cakes, or other forms	20 per cent ad valorem
1922	68	Pigments, colors, stains, and paints, including enamel paints, whether dry, mixed, or ground in or mixed with water, oil or solutions other than oil, not specially provided for ...	25 per cent ad valorem
1930	66	Pigments, colors, stains, and paints, including enamel paints, whether dry, mixed, or ground in or mixed with water oil or solutions other than oil, not specially provided for ...	25 per cent ad valorem

EXPORTS

Statistics of exports are lacking. Although large quantities of mixed paints (containing in the aggregate a considerable quantity of these pigments) are exported, the exports of umber, sienna, and other brown earth pigments, either dry or ground in oil or water are probably negligible.

THE INDUSTRY IN FOREIGN COUNTRIES

Umber, sienna, and other brown earth pigments are found throughout the world, but certain countries are noted for their pigments because of their high quality.

Specially fine qualities of umber are produced in Cyprus, Sicily, Asia Minor, and the Netherlands. German deposits also have yielded considerable quantities, and at one time its umber ranked with that produced in Cyprus. Turkish umber, produced chiefly in Cyprus, is the world standard on this pigment and dominates the markets of all countries, although the production in Sicily is almost as large and of good quality.

Italian sienna likewise enjoys a world-wide reputation, the output coming primarily from Tuscany. The Harz Mountains in Germany are the only other important source of supply, although small amounts are produced elsewhere, notably in Sicily. The Sicilian product, however, is shipped to the mainland of Italy for further treatment.

Italy.- Table 12 shows the production of all mineral pigments in Italy for the years 1920 to 1929.

The chief producing centers in recent years are in the provinces of Verona, Cagliari, and Grosseto. Prior to the World War, the provinces of Siena and Grosseto were much more important producers, but immediately after the war and for some three or four years these provinces produced only minor quantities. During the past three years, however, Grosseto has increased its production until it has become one of the three leading producers. Other provinces which have produced in recent years are, Cuneo, Trento, Livorno, Udine, and several others of minor importance.

Leghorn for many years has been the marketing center for Italian siennas, and much of the crude earth is prepared there. Considerable umber from Cypress is also brought to this port for preparation and marketing.

Table 12.- Production of mineral pigments in Italy[1]
(Metric tons)

Province	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
Verona	5,400	6,000	4,245	5,830	4,818	5,270	7,620	4,850	4,520	6,700
Cagliari	2,338	2,338	1,460	1,500	2,160	1,944	2,114	120	280	187
Vicenza	1,350	550	450	550	- -	- -	- -	40	- -	46
Cuneo	1,100	650	200	120	350	100	150	- -	- -	- -
Trento	1,000	30	30	90	64	300	146	40	70	70
Perugia	550	150	- -	330	- -	- -	- -	- -	- -	400
Siena	50	100	100	120	120	120	890	200	200	200
Grosseto	50	50	50	900	1,900	1,900	1,900	1,400	1,527	2,020
Livorno	- -	- -	- -	- -	- -	310	310	- -	143	45
Napoli	- -	- -	- -	- -	- -	- -	- -	100	120	100
Viterbo	- -	- -	- -	- -	- -	- -	- -	- -	- -	900
Friuli	- -	- -	- -	870	- -	119	229	- -	- -	- -
Udine	- -	- -	- -	- -	- -	- -	- -	311	200	- -
Roma	- -	- -	- -	- -	- -	- -	- -	- -	120	- -
Total	11,838	9,868	6,505	11,310	9,412	10,063	13,359	7,061	8,260	10,668

1/ Rivista del Servizio Minerario, Rome (Annual).

Cyprus.- Umber, known as Turkish umber, is produced chiefly in the Larnaka district of the island of Cyprus. At present there are two plants producing umber for market, their combined capacity being estimated at about 10,000 tons annually.

Practically all of the output from Cyprus is exported. The exports average about 5,000 to 6,000 tons annually. Prior to the World War, England and Italy were the principal destinations but to-day the United States purchases more than half of the total, with England and Italy following in the order named.

It has been estimated that Cyprus could produce 50,000 tons annually if the market could absorb such an amount.

Table 13 shows the exports of umber (Terra Umbra) for Cyprus for the years 1924 to 1929, inclusive. All of these shipments are made through the port of Larnaka.

Table 13.- Exports of terra umbra from Cyprus, 1924-1929[1]
(Long tons)

Country	1924	1925	1926	1927	1928	1929
United Kingdom	1,326	1,803	1,109	1,428	1,867	1,894
France	50	51	45	82	198	161
Germany	147	129	- -	1	3	5
Greece	- -	7	1	3	- -	5
Holland	- -	81	59	244	104	25
Italy	655	524	1,043	589	1,043	947
United States	2,569	3,372	3,104	3,196	2,575	3,550
Other Countries	84	2	- -	23	2	- -
Total	4,831	5,969	5,361	5,566	5,792	6,587

1/ Cyprus Year Book, Nicosia, Cyprus (Annual).

MARKETING AND PRICES

Domestic production of umber and sienna has never been large, and the output is generally controlled by a few producers who handle a wide variety of natural mineral pigments, both domestic and imported material, and have built up reputations for uniformity and high grade of products. The larger consumers of pigments prefer to deal only with such companies rather than buy each color from a different small producer. In this manner, imported umber and sienna and other brown earth pigments are sold side by side with domestic pigments, and due to the high standard of the imported materials, American pigments encounter severe competition. Some of the smaller producers market their product through brokers or jobbers.

The yearly price range for the various grades of umber and sienna both domestic and foreign, is shown in Tables 14 and 15. As will be seen, the prices quoted for foreign umber and sienna are only slightly higher than those for domestic pigments, despite their generally superior reputation.

Table 16 shows the yearly price range for Vandyke or Cassel brown.

Table 14.- Prices of umber, domestic and imported, in New York[1]
(Cents per pound)

Year	American, per pound, in carload lots		Turkish, per pound				
			Dry				In oil
	Burnt and powdered	Raw	Burnt and powdered	Burnt lump selected[2]	Raw and powdered	Raw in lumps	Burnt or raw
1915	2 -2½	2¾ -3	3 - 4	3 - 5	2 3/8-3½	3 - 5	11 - 14
1916	2 -2½	2 -3	3 - 5	3½ - 6	3 -3½	3½ - 5	11 - 21
1917	2 -5	2 -5	4 - 7½	4½ - 6	3 -6	3½ - 5	15 - 21
1918	3½ -4	3 -3½	4½ - 7	4½ - 6	4½ -6½	4 - 5	17 - 27
1919	3½ -4	3 -3½	5 - 7	5 - 7	3/	3/	25 - 30
1920	3½ -6	3 -6	5 - 7	5 - 7	4½ -6	6	28 - 30
1921	4½ -5	3½ -5	5½ - 7	-	6	-	24 - 28
1922	3¾ -4 5/8	3¾ -4 5/8	4¼	-	4¼	-	19 - 22
1923	3¾ -4 5/8	3¾ -4 5/8	4	-	4	-	19 - 22
1924	3½ -4½	3½ -4½	4	-	4	-	-
1925	3¼ -4½	-	4 - 6	-	4	-	-
1926	3 -3¼	-	4	-	4	-	-
1927	3	-	4	-	4	-	-
1928	2 7/8-3½	2 7/8-3½	4 - 6	-	4 -6	-	-
1929	2 7/8-3	-	4	-	-	-	-
1930	2 7/8	-	4	-	-	-	-

1/ Oil, Paint, and Drug Reporter, New York (Weekly).
2/ In ton lots.
3/ Nominal.

Table 15.- Prices of sienna, domestic and imported, in New York[1]
(Cents per pound)

Year	Italian Sienna		American Sienna
	In oil	Burnt	Burnt and powdered
1914	12 - 15	4 - 7	2¼ - 3
1915	12 - 15	4 - 7	2¼ - 3
1916	12 - 22	5 - 8	2 - 3
1917	16 - 32	5½ - 10	2 - 3
1918	18 - 28	6 - 15	2 - 4
1919	26 - 32	7 - 15	2½ - 4
1920	30 - 32	5½ - 16	2½ - 7½
1921	26 - 30	6½ - 15	4¼ - 7½
1922	21 - 25	6 - 14½	3¾
1923	21 - 25	6 - 14½	3¾
1924	4½ - 5½	-	3½ - 3¾
1925	3 - 4½	-	3
1926	3 - 4	-	3
1927	4 - 5	-	3
1928	5 - 5½	5 - 12½	3 - 4
1929	5½	-	3
1930	5½	-	3

1/ Oil, Paint, and Drug Reporter, NewYork (Weekly).

Table 16.- Prices of Vandyke or Cassel brown, domestic, in New York[1]
(Cents per pound)

Year	Dry	In oil
1914	2½ - 3	11 - 14
1915	2½ - 3	11 - 14
1916	3 - 4	11 - 14
1917	10	25 - 30
1918	4 - 7	25 - 30
1919	2½ - 4	25 - 35
1920	2½ - 5	(Not quoted)
1921	3½ - 5	25 - 28
1922	3½ - 4½	30 - 32
1923	2/ 4 7/8	30 - 32
1924	2/ 4 - 4½	30 - 32
1925	2/ 4 - 4½	-
1926	2/ 4 - 4½	-
1927	2/ 4	-
1928	2/ 4 - 4½	-
1929	2/ 4½ - 4½	-
1930	2/ 4½ - 4½	-

1/ Oil, Paint and Drug Reporter, New York (Weekly).
2/ Imported material.